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Briefing Report to the Chairman,
Subcommittee on Defense, Committee
on Appropriations, House of
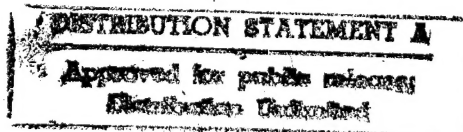Representatives

December 1989

BATTLEFIELD AUTOMATION

Army's Air Defense Command and Control System Status and Program Issues

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The Honorable John P. Murtha
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

As requested by the former Chairman, we are providing information on
the technical performance, delivery schedules, and cost of the Army's
Forward Area Air Defense Command, Control, and Intelligence (FAAD
C2I) system. FAAD C2I includes four components: (1) computers and soft-
ware for system automation of command and control functions (desig-
nated FAAD C2), (2) a ground-based sensor to detect and track aircraft,
(3) an aerial sensor to detect helicopters and other low-flying aircraft
hidden from the ground-based sensor's view, and (4) devices to distin-
guish between friendly and threat aircraft. This report is an interim
report on the current status of the four FAAD C2I components. We are
continuing to evaluate the merit of fielding FAAD C2I in light of the devel-
opment problems being encountered by the program. The results of our
work to date are summarized in this letter and more fully discussed in
appendix I. Appendix II describes our objective, scope, and
methodology.

Background

The Army is acquiring FAAD C2I to automate command and control of the
short-range air defense weapons it plans to deploy in fiscal year 1993.
The system is to automatically detect and identify incoming aircraft and
provide targeting and tracking information to air defense units operat-
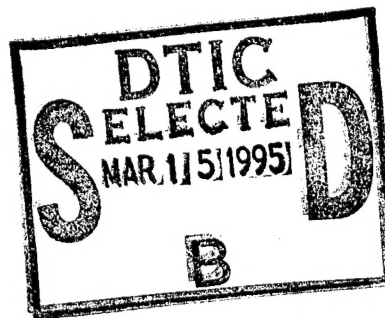ing in forward combat zones.

Results in Brief

An initial FAAD C2I system, consisting of only the FAAD C2 computer sys-
tem and accompanying software, is scheduled to be deployed in fiscal
year 1993. However, it will not have some of the capabilities originally
planned and is to be improved after deployment. The ground-based sen-
sor, the aerial sensor, and the advanced aircraft identification equip-
ment will not be deployed until fiscal year 1996 or 1997. Without these
components, FAAD C2I will not have sufficient ability to detect and posi-
tively identify hostile aircraft. In addition, the FAAD C2I cost estimate of
$2.6 billion, projected in August 1986 when the program was approved,
has increased to $3.2 billion and is likely to increase further.

FAAD C2

The Army delayed its fielding of the FAAD C2 component from fiscal year 1991 to fiscal year 1993. Because of additional program and schedule problems that jeopardized the 1993 fielding, the Army scaled-down some capabilities of the FAAD C2 component to allow fielding an initial system by that time. While the modified version is to provide automated command and control for FAADS air defense units, other capabilities were deferred, such as the ability to automatically pass warnings of the presence of threat aircraft to other battlefield units. The Army now plans to add these capabilities after the system is deployed.

Ground-Based Sensor

The Army canceled plans to acquire a nondevelopmental item[1] ground-based sensor because it could not meet performance specifications. The Army is revising the sensor's performance specifications to make them less stringent and soliciting new proposals for a nondevelopmental sensor that will meet the new specifications. Originally planned for deployment in fiscal year 1991, the ground-based sensor is now scheduled for deployment in fiscal year 1996. The Army plans to incorporate into this sensor more advanced technology as it becomes available to fully meet the Army's requirements.

Aerial Sensor

The aerial sensor has been deferred and will not be deployed with other system elements. Fiscal years 1990 and 1991 funds for its development were deleted from the budget by the Office of the Secretary of Defense because the sensor's requirements document had not been approved. The Army had not determined the sensor type or whether it would have its own airborne platform or share an existing platform. As a result, the Army estimates deployment will not occur before fiscal year 1997. Until then, FAAD C2I will not have a sensor to detect and track targets hidden from the ground sensor's view by hills and terrain.

Aircraft Identification Devices

The programs for FAAD C2I's aircraft identification devices have been delayed. Their deployment is now scheduled for the mid-to-late 1990s. In the interim, the Army plans to use existing devices. As a result, the initially deployed FAAD C2I system will not have sufficient capability to

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[1]Nondevelopmental item means any item that is either (1) commercially available, (2) in use by a U.S. agency or foreign government with which the United States has a mutual defense cooperation agreement, or (3) any of these items that requires only minor modification.

positively identify threat aircraft nor have fully secure and jam resistant friendly aircraft identifying capability. The Army may also add another, more advanced, identification device to FAAD C2I.
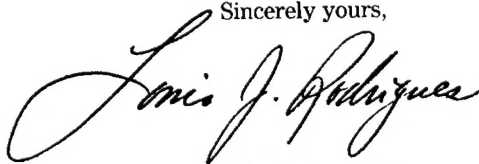
Cost

FAAD C2I's 1986 cost estimate of $2.6 billion has increased to $3.2 billion. However, this estimate does not include the costs associated with the (1) planned ground-based sensor improvements, (2) possible addition of another aircraft identification system, (3) possible need for a dedicated platform for the aerial sensor, and (4) potential cost impact of deferring some FAAD C2 capabilities to adhere to a 1993 fielding schedule. The $3.2 billion estimate could increase substantially depending upon the Army's final decision on these items. Army estimates indicated costs could be about $375 million for ground-based sensor improvements, $600 million for the additional aircraft identification device, and uncertain but potentially additional amounts for an aerial sensor platform and FAAD C2 improvements.

As requested, we did not obtain official agency comments on this briefing report. However, we discussed its contents with officials from the Office of the Secretary of Defense and the Department of the Army and have incorporated their comments where appropriate.

Unless you publicly announce its contents earlier, we plan no further distribution of this briefing report until 30 days from the date of this letter. At that time, we will send copies to interested parties and make copies available to others on request.

Please contact me at 275-4841 if you or your staff have any questions concerning the briefing report. Other major contributors to this briefing report are listed in appendix III.

Sincerely yours,

Louis J. Rodrigues
Director, Command, Control, Communications,
    and Intelligence Issues

Contents

Abbreviations

ATCCS   Army Tactical Command and Control System
FAAD C2I Forward Area Air Defense Command, Control, and Intelligence

Army Forward Area Air Defense Command and Control System Status and Problems

The Army's FAAD C2I system is intended to automate command and control of the Army's short-range air defense weapons. It is to automatically detect and identify incoming enemy aircraft flying at low altitudes and disseminate tracking and targeting information to forward area air defense units. This information will alert air defense units to approaching enemy aircraft and enable them to pivot their weapons toward the targets.

FAAD C2I consists of the following four components:

- FAAD C2 is the computer equipment and software for automating the processing and dissemination of air defense command and control tracking and targeting information.
- The ground-based sensor is a radar that detects and tracks aircraft and passes the information to FAAD C2 for processing and dissemination.
- The aerial sensor is planned to be an airborne radar to detect helicopters and other aircraft hidden or "masked" from the ground-based sensor's view. The aerial sensor is now called the "masked target" sensor.
- The aircraft identification component consists of two elements for distinguishing between friendly and threat aircraft. One element, called identification friend or foe, identifies aircraft by recognizing electronic signals transmitted by friendly aircraft. The Army plans to use the existing Mark XII system in initial deployments and begin using the Mark XV system in fiscal year 1997. The identification friend or foe element is sometimes referred to as a cooperative or "question and answer" system. It consists of an interrogator on the ground, which electronically "questions" the aircraft, and a transponder on the aircraft, which answers the query. However, failure of the interrogator to receive a proper answer does not necessarily mean that the aircraft is hostile. For example, a friendly aircraft's transponder could fail to function properly. Hence, the Army requires the second FAAD C2I aircraft identification element to better ensure that friendly aircraft are not shot down. This element, which the Army calls a noncooperative target recognition system, identifies hostile aircraft by comparing the characteristics of incoming aircraft with known aircraft characteristics.

As shown in figure I.1, FAAD C2I will be integrated with the Army Tactical Command and Control System (ATCCS), a larger program to automate, with common computer hardware and software, the command and control of the five battlefield functional areas—air defense, maneuver control, fire support, combat service support, and intelligence. Computers for FAAD C2I are being acquired under this program. FAAD C2I is supposed to interoperate with the other ATCCS battlefield command and control

systems. For example, it is to provide battlefield commanders, through the Maneuver Control System, information on attacking enemy aircraft, concept of operations, and air defense artillery locations. It is also intended to receive information on missions, courses of actions, schemes of maneuver, and priorities.

Figure I.1: Army Tactical Command and Control System
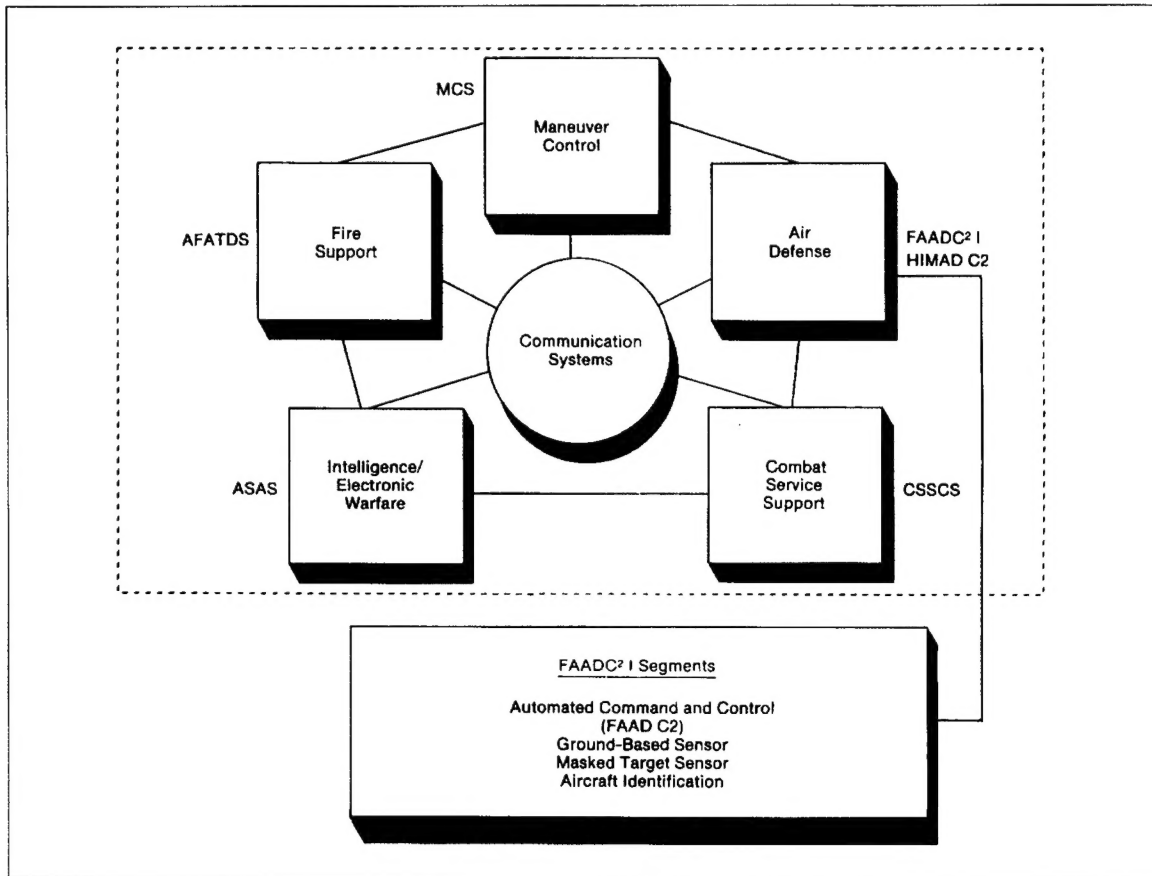
Abbreviations

AFATDS   Advanced Field Artillery Tactical Data System.
ASAS   All Source Analysis System.
CSSCS   Combat Service Support Control System.
HIMAD C2   High-to-Medium Air Defense Command and Control.
MCS   Maneuver Control System.

The Army plans to acquire 31 FAAD C2 sets and 127 ground-based sensors. The quantities of aerial sensors and aircraft identification devices have not been finalized.

FAAD C2I—Late and Initially Less Capable Than Planned

Since approved in August 1986, FAAD C2I's deployment schedule has slipped from fiscal years 1991 to 1993 and as late as 1996 for the ground-based sensor and 1997 for the aerial sensor and the Mark XV cooperative aircraft identification system. The initial FAAD C2I system, scheduled for deployment in fiscal year 1993, will consist of only the FAAD C2 computer system. However, it will not have some capabilities originally planned and is to be improved after deployment. Moreover, FAAD C2I, without the ground-based sensor, the aerial sensor, and the advanced aircraft identification equipment, will not have sufficient ability to detect or positively identify hostile aircraft.

FAAD C2 System Delayed and Capabilities Reduced

According to project officials, FAAD C2's initial deployment date was delayed in part because of delays in procuring the common ATCCS computers for the system. Further delays were anticipated in early 1989 because of funding problems. Therefore, the Army decided to restructure the program to permit deployment of a system in fiscal year 1993 but without some of the originally planned capabilities.

The Army expects the scaled-back FAAD C2 system to have sufficient software capability to accomplish the automatic dissemination of aircraft information to FAADS air defense units. However, it will not initially have the capabilities, originally required at fielding, to automatically

- warn other battlefield units of attacking enemy aircraft or receive information from commanders regarding their missions, courses of action, execution orders, and fire requests;
- exchange information on enemy aircraft with other U.S. and allied air defense units, such as the Army's Patriot and Hawk missile units, to better coordinate the air battle;
- pass threat warnings and air battle status to intelligence units or receive intelligence information on the enemy's status; and
- report on friendly forces and the status of supplies and equipment, or provide enhanced aircraft identification capabilities.

According to project officials, the Army plans to begin a software development program in fiscal year 1991 to add the excluded capabilities and begin deploying the improved software in fiscal year 1994. Until then,

the above battlefield information transfer functions will be accomplished by voice communications and manually entering the data into computer terminals, rather than automatically sending information between command and control computer centers in data form.

Ground-Based Sensor Delayed and Initial Capabilities Limited

The ground-based sensor program, already 2 years behind schedule, encountered another setback in June 1989 when the Army canceled plans to procure the candidate nondevelopmental item sensor being evaluated. The Army canceled its procurement plans because testing of the candidate sensor in late 1988 showed that it would not meet minimum performance requirements. The sensor testing disclosed that it

- required excessive time to detect the targets after they flew into its field of view;
- failed to adequately detect multiple targets flying on the same bearing;
- showed an inability to detect slow-flying and hovering helicopters; and
- indicated, in an excessive number of instances, that it was tracking aircraft when none were present.

After the test, the Army concluded that available sensors were not technically capable of meeting FAAD C2I performance specifications. The Army decided to reduce the sensor's performance specifications and solicit new proposals for additional nondevelopmental item sensor candidates.

In addition, the Army has dropped its plans to deploy the ground-based sensor in fiscal year 1993 and now plans to deploy it in fiscal year 1996. According to the ground-based sensor program manager, a contract for nine preproduction sensors will be awarded in December 1990, with testing planned in fiscal year 1993. The full-scale production decision is scheduled for early 1994.

The Army does not expect any available candidate to meet its long-range performance requirements. Accordingly, the Army plans to improve the sensor's performance through a modification program during and after system deployment.

Aerial Sensor Program Deferred

Deployment of the aerial sensor, originally proposed for fiscal year 1991, has been deferred until at least fiscal year 1997. According to Army officials, the aerial sensor is needed to provide increased air surveillance for targets that might be hidden from view of the ground-

based sensor. At this time, there is no Army approved aerial sensor design or platform; nor any planned funding for the program until at least fiscal year 1992.

In 1988, we reported[1] that the Army had chosen not to request fiscal year 1989 funds for the aerial sensor's development. In 1989, the Office of the Secretary of Defense eliminated program funding for fiscal years 1990 and 1991 because the Army requirement for the sensor had not been approved. For example, the Army had not defined the sensor type or whether the sensor would have its own airborne platform or share an existing platform. The Army expects to approve the requirement by fiscal year 1991.

Aircraft Identification Devices Delayed

FAAD C2I will not have its advanced aircraft identification devices for 1 to 4 years after the fiscal year 1993 deployment. Both the cooperative identification friend or foe and the two noncooperative target recognition devices for FAAD C2I have been delayed.

The cooperative identification system, which is capable of identifying friendly aircraft but not threat aircraft, is to be the Mark XV. This system is being developed by the Air Force as a triservice program that is to be interoperable with similar devices of the North Atlantic Treaty Organization forces. The Mark XV, originally scheduled to be available in fiscal year 1992, was delayed by the Air Force. However, it is now in full-scale development and is scheduled for deployment in 1997. Until then, the Army plans to use the existing Mark XII system, that is not as reliable, especially in a jamming environment.

Both FAAD C2I noncooperative target recognition devices, which positively identifies threat aircraft, have also been delayed because of difficulties in finalizing the requirements document. One of the devices is now scheduled for deployment in fiscal year 1994 and the other in fiscal year 1995. Until these devices are deployed, FAAD C2I will not have the capability to positively identify threat aircraft.

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[1]DOD Acquisition Programs: Status of Selected Systems (GAO/NSIAD-88-160, June 30, 1988).

Program Cost Has Increased and Is Still Uncertain

The Army's FAAD C2I cost estimate, in then year dollars, has increased from $2.6 billion to $3.2 billion since the program was approved in 1986. (See table I.1.) The $3.2 billion estimate does not include the cost of planned ground-based sensor improvements. Other significant cost increases could occur depending upon the aerial sensor platform to be used and the Army's decision on fielding an additional noncooperative aircraft identification device.

Table I.1: FAAD C2I Cost Changes

Dollars in millions

Cost element	8/86 estimate	6/89 estimate	Change
Development:			
FAAD C2	$465.2	$547.9	$82.7
Ground-based sensor	35.0	114.0	79.0
Aerial sensor	136.2	136.5	0.3
Aircraft identification	305.6	332.2	26.6
Total	**942.0**	**1,130.6**	**188.6**
Procurement:			
FAAD C2	304.3	335.4	31.1
Ground-based sensor	533.6	467.3	(66.3)
Aerial sensor	665.0	360.3	(304.7)
Aircraft identification	195.2	877.3	682.1
Total	**1,698.1**	**2,040.3**	**342.2**
Development and procurement:			
FAAD C2	769.5	883.3	113.8
Ground-based sensor	568.6	581.3	12.7
Aerial sensor	801.2	496.8	(304.4)
Aircraft identification	500.8	1,209.5	708.7
Total	**$2,640.1**	**$3,170.9**	**$530.8**

FAAD C2 Cost

Since 1986, the FAAD C2 component cost estimate of $769.5 million increased by $113.8 million. A program official attributed this increase primarily to inflation and delays in delivering the computer provided by the Army from the ATCCS program.

The Army is uncertain of the cost associated with changing the FAAD C2 component to adhere to the 1993 fielding schedule by deferring some capabilities until after the system is fielded. The extent, if any, that these changes will increase the cost estimate has not been determined. Also, in September 1989, the Army completed negotiations of a

$45.9 million cost overrun with the FAAD C2 contractor. This cost overrun is not included in the June 1989 cost estimate.

Ground-Based Sensor Cost

The 1986 ground-based sensor cost estimate of $568.6 million has increased by $12.7 million. This estimate does not include the costs of the planned improvements to be made after the system is fielded. Further, since plans to procure the candidate sensor were canceled, and the Army is soliciting other candidates, the current $581.3 million estimate for the initial system may not be valid. Also, Army officials said that since available sensors cannot meet its long-range performance requirements, the Army will improve the sensor after it is deployed. According to the contractor for the recently canceled sensor effort, the improvement program for its sensor could have cost as much as $375 million.

Aerial Sensor Cost

Since 1986, the program manager reduced the estimated aerial sensor cost of $801.2 million by $304.4 million. The program manager based this reduction primarily on the assumption that, rather than procure a new aircraft, the cost of an airborne platform for the aerial sensor could be deleted by sharing an existing airborne platform, the Black Hawk helicopter, which carries other sensors.

However, the Army did not concur with proposals to place the aerial sensor on the Black Hawk platform with other sensors due to the differences in missions. The Army has not determined the final type of aerial sensor or its airborne platform. Thus, the current aerial sensor system cost estimate of $496.8 million is preliminary and the cost of an airborne platform may have to be included again.

Aircraft Identification Cost

The aircraft identification element's $1,209.5 million estimate represents an increase of $708.7 million over the $500.8 million estimated in 1986. According to an Air Defense Command and Control Systems Project Office official, the increase was due primarily to a decision to place multiple rather than single noncooperative target recognition devices on the FAAD C2I ground-based sensor. Current plans are not yet firm and the cost estimate is subject to change. For example, the estimate could increase by about $600 million if an additional noncooperative target recognition device being developed is added to meet current FAAD C2I requirements. Although the Army has not made the final decision to include the additional device, the program is funded and it is included in

the Army Material Plan for Air Defense. The new device is not scheduled to enter full-scale development until fiscal year 1992.

Objective, Scope, and Methodology

As requested by the former Chairman, Subcommittee on Defense, House Committee on Appropriations, we reviewed the technical performance, delivery schedules, and cost of the Army's FAAD C2I system. Because of concerns expressed by the former Chairman, we concentrated on the status of the system's ground-based sensor and aerial sensor components. However, because of problems encountered by the Army, we also reviewed the status of the other system components.

We examined acquisition plans, schedules, and cost estimates, requirements documents, test plans and reports, and other documents as necessary to determine the progress and status of the program. In addition, we discussed the system's performance, schedule, and estimated costs with the Air Defense Command and Control Systems project manager and his staff to determine the reasons for and effect of various changes in the program. We also discussed a draft of this report with representatives from the program offices of the various FAAD C2I components and included their comments where appropriate.

We performed our work primarily at the U.S. Army Missile Command, Huntsville, Alabama. We obtained other data from the U.S. Army Air Defense Artillery School, Fort Bliss, Texas, and the U.S. Army Communications-Electronics Command, Fort Monmouth, New Jersey.

Our review was performed from August 1988 through September 1989 in accordance with generally accepted government auditing standards.

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